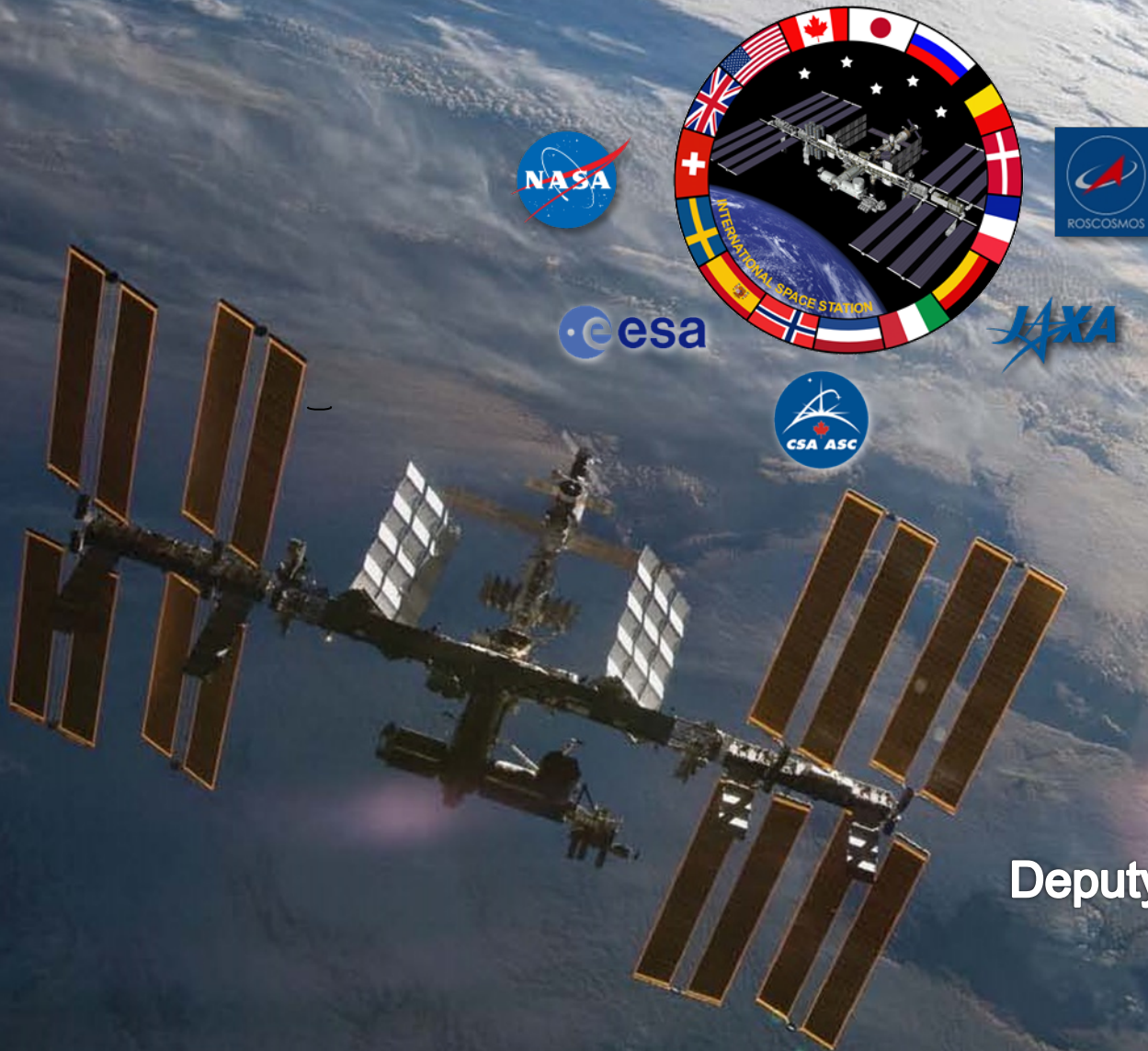


# Status of the ISS USOS

## NASA Advisory Council HEOMD Committee



Daniel W. Hartman  
Deputy Manager, ISS Program  
July 2014



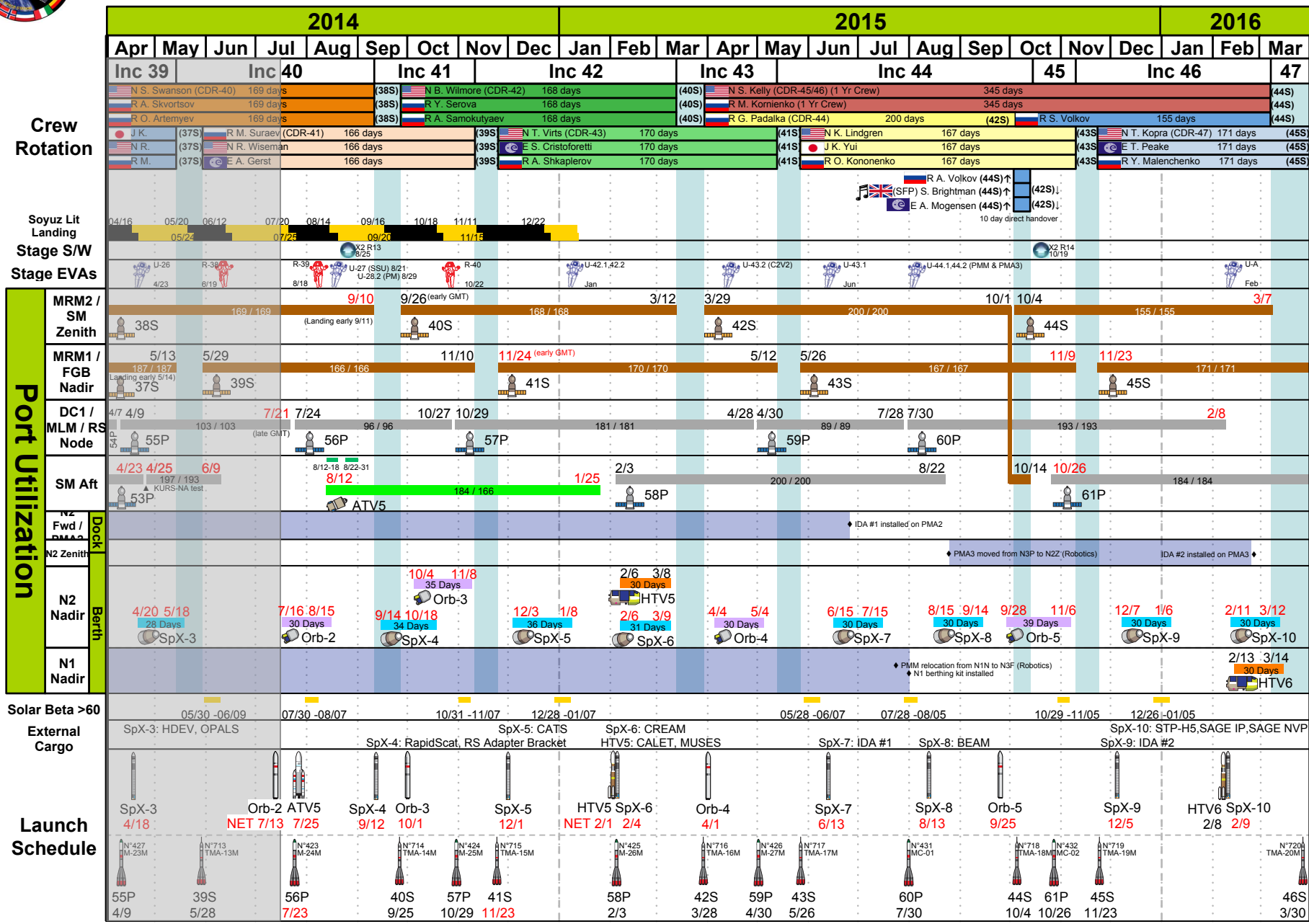
For current baseline refer to  
SSP 54100 Multi-Increment  
Planning Document (MIPD)

# ISS Flight Plan

## Flight Planning Integration Panel (FPIP)

(Pre-decisional, For Internal Use, For Reference Only)

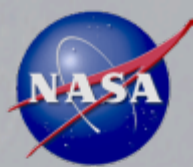
NASA: OC4/John Coghessall  
MAPI: OP/Randy Morgan  
Chart Updated: July 15th, 2014  
SSCN/CR: 14071 + 14145 + 14211 (In-Work)







# 39 Soyuz Launch/Expedition 40



**Vehicle:** 39 Soyuz

**Launch:** May 28, 2014; (with 4 orbit rendezvous)

**Docking:** May 29, 2014;

**Undock/Landing:** November 10, 2014

## 38 Soyuz crew

**Alexander Skvortsov, Soyuz Commander**

**Oleg Artemiev, Flight Engineer**

**Steve Swanson, Flight Engineer**



## 39 Soyuz Crew

**Maxim Suraev, Soyuz Commander**

**Reid Wiseman, Flight Engineer**

**Alexander Gerst (ESA), Flight Engineer**

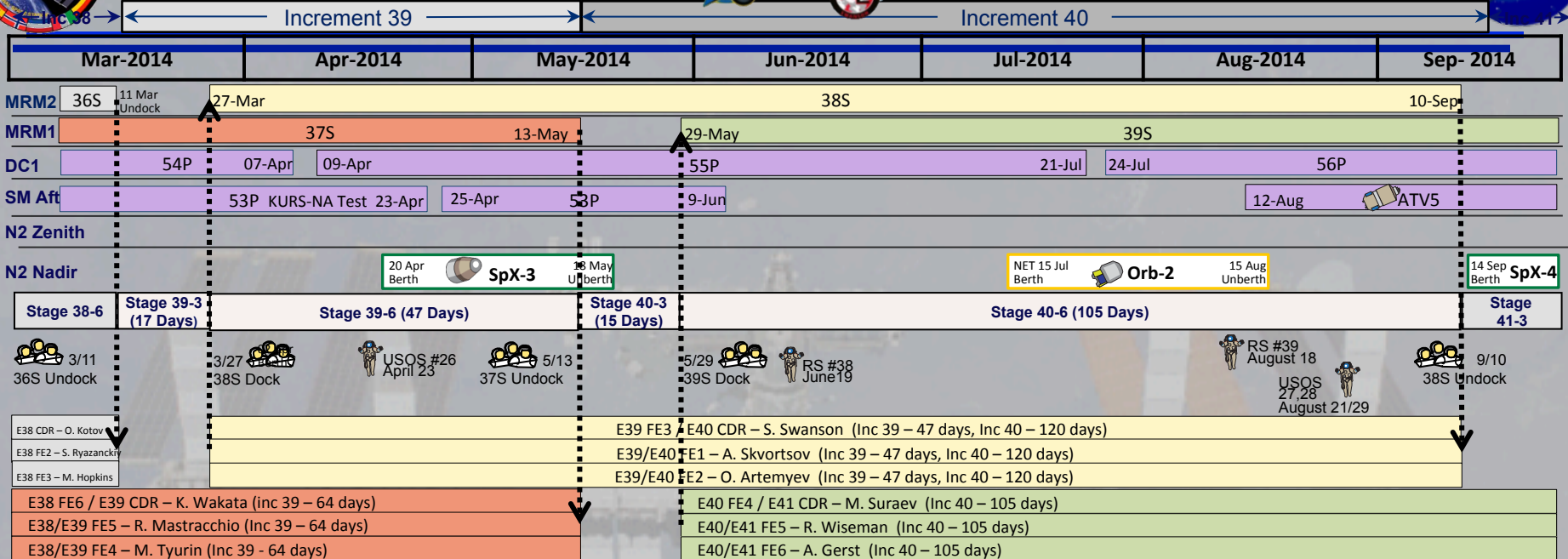




# INCREMENTS 39 & 40



Updated 1 July 2014 All dates GMT  
IDRD Rev A CR 14000  
MIPD CR 14071 + 14145 + 14211 (in work)



	Stage 39-3	Stage 39-6	Stage 40-3	Stage 40-6
EVA, Robotics, Systems, Software	<ul style="list-style-type: none"> <li>National Geographic live events</li> </ul>	<ul style="list-style-type: none"> <li>X2R12.1</li> <li>53P KURS-NA Test</li> <li>USOS EVA 26: EXT-2 MDM R&amp;R</li> <li>Relocate SMILES</li> </ul>	<ul style="list-style-type: none"> <li>JEM Airlock: CLPA install</li> </ul>	<ul style="list-style-type: none"> <li>US EVAs 27/28: SSU 3A R&amp;R, PM to ESP-2, WETA/VSSA relocate, ETVCG &amp; luminaires, APFR/TS relocate</li> <li>RS EVA 38 &amp; 39: vehicle tasks, jettisons, science operations</li> <li>NORS AIK install</li> <li>SSC System 5 install</li> <li>Casablanca Server and Network Monitoring System</li> </ul>
Utilization	<ul style="list-style-type: none"> <li>SpX3 External: HDEV and OPALS install</li> <li>SpX3: T-cells, crossover science</li> <li>Human Research</li> <li>Ocular Health</li> <li>Survey: STP-H4 &amp; SCAN</li> </ul>		<ul style="list-style-type: none"> <li>Human Research</li> </ul>	<ul style="list-style-type: none"> <li>JEM Airlock: Cubesats (2)</li> <li>ATV5: LIRIS</li> <li>EDR outfitting</li> <li>Zebrafish Prep</li> <li>Nanoracks</li> <li>Comm Delay Assessment</li> <li>IVA Clothing</li> <li>Robonaut Leg Install</li> <li>SPHERES Zero Robotics, Rings, SLOSH, Vertigo, SmartPhone</li> <li>BASS</li> <li>BCAT</li> <li>Force Shoes</li> <li>SOLAR Bridging</li> <li>AMS Survey</li> </ul>

37 Soyuz Crew

38 Soyuz Crew

39 Soyuz Crew

IM - Ryan Lien (x47284), IDM - Cordt Cashen (x33487)  
IPM - Gaurang Patel (x30023)  
IE - Karen Engelauf (x40860), Cindy Cranford (x47677)  
IPE - Maria Baugh-Horstman (x38412)





# Expedition 40 Objectives (May 2014 – September 2014)



## ➤ Support planned visiting vehicle traffic:

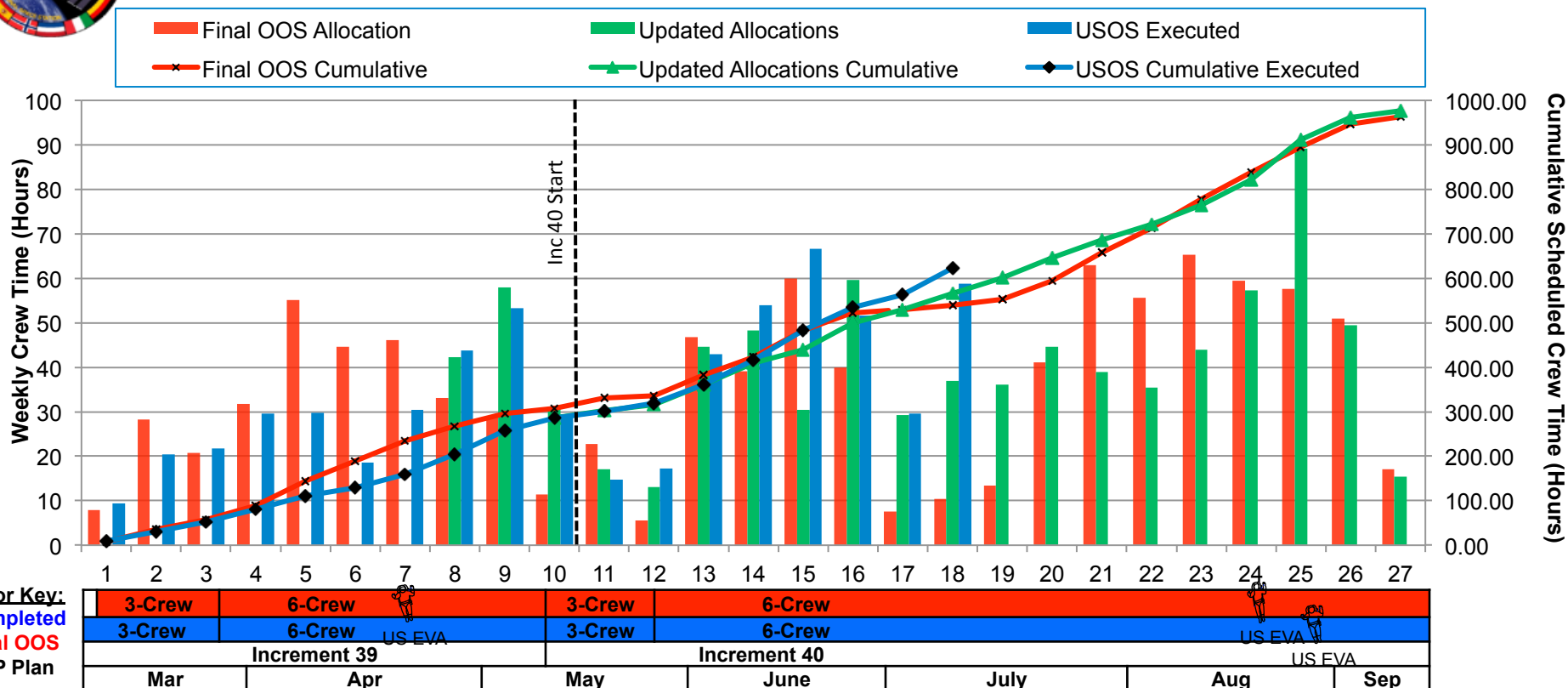
- SpX-3 Unberth May 18
- 39S Launch and Docking May 28/29
- 53P Undock June 9
- Orb-2 Launch July 13
- Orb-2 Berth July 16
- Orb-2 Unberth Aug 15
- 55P Undock July 22
- 56P Launch July 23
- 56P Docking July 24
- ATV-5 Launch July 29 (in work)
- ATV-5 Dock August 12
- 38S Undock and Landing September 10/11

## ➤ Significant tasks:

- RS EVAs 38 (6/21) and 39 (8/18): vehicle tasks and science tasks
- USOS EVAs, pending return to nominal EVA operations
  - August, EVA 27-SSU (8/21): Remove and replace Sequential Shunt Unit and other tasks
  - August, EVA 28-PM (8/29): Pump Module move, preparation for docking hardware installation
- Joint US/Russian utilization: SPHERES Zero Robotics, Sally Ride EarthKAM, IVA Clothing
- JEM Airlock payloads: Nanorack Cubesat deploys (after Orb-2), RRM2
- SSC System 5 Upgrade



# Inc 39-40 Utilization Crew Time



Executed through Increment Wk (WLP Week) 18 =	16.4	of 24.8 work weeks (66.13% through the Increment)
USOS CSRD Allocation:	976.2	hours (39.4 hrs/wk; Allocation increased from 960.5 to 976.2)
OOS USOS Planned Total:	963.58	hours
USOS Actuals:	622.17	hours
	63.73%	through CSRD Allocation
	64.57%	through OOS Planned Total
Total USOS Average Per Work Week:	37.94	hours/work week
Voluntary Science Totals to Date:	0	hours (Not included in the above totals or graph)
RSA/NASA Joint Utilization to Date:	2.92	Hours (not included in the above totals or graph)

OC/OZ reconciliation is  
not complete for Week 18





# Total ISS Consumables Status



	T1: Current Capability (Includes Orb-2)		T2: Current Capability + 56P	
Consumable – based on current, ISS system status	Date to Reserve Level	Date to zero supplies	Date to Reserve Level	Date to zero supplies
Food – 100%	October 18, 2014	December 9, 2014	December 8, 2014	January 22, 2015
KTO	January 28, 2015	March 16, 2015	April 6, 2015	May 28, 2015
Filter Inserts	May 11, 2015	July 2, 2015	August 1, 2015	September 15, 2015
Toilet (ACY) Inserts	September 23, 2015	November 2, 2015	September 23, 2015	November 2, 2015
EDV + TUBBS (UPA Operable)	March 8, 2015	August 2, 2015	May 26, 2015	October 4, 2015
Pre-Treat Tank	November 7, 2014	December 29, 2014	August 23, 2015	October 6, 2015
Consumable - based on system failure				
EDV + TUBBS (UPA Failed)	November 14, 2014	January 20, 2015	January 6, 2015	March 9, 2015
Water, if no WPA (Ag & Iodinated)	September 2, 2014	November 17, 2014	October 6, 2014	December 16, 2014
O <sub>2</sub> if Elektron supporting 3 crew & no OGA	August 9, 2014	December 31, 2014	August 21, 2014	January 13, 2015
O <sub>2</sub> if neither Elektron or OGA	July 20, 2014	September 22, 2014	July 27, 2014	September 30, 2014
LiOH (CDRAs and Vozdukh off)	~0 Days	~14 Days	~0 Days	~14 Days



# USOS Consumables Status



	U1: Current Capability (Includes Orb-2)		U2: Current Capability + 56P	
Consumable – based on current, ISS system status	Date to Reserve Level	Date to zero supplies	Date to Reserve Level	Date to zero supplies
Food – 100%	January 2, 2015	February 15, 2015	January 2, 2015	February 15, 2015
KTO	January 18, 2015	March 4, 2015	January 18, 2015	March 4, 2015
Filter Inserts	June 29, 2015	August 13, 2015	June 29, 2015	August 13, 2015
Toilet (ACY) Inserts	April 15, 2016	June 10, 2016	April 15, 2016	June 10, 2016
EDV + TUBBS (UPA Operable)	January 7, 2015	November 30, 2015	January 7, 2015	November 30, 2015
Pre-Treat Tanks	July 22 , 2014	September 5, 2014	September 25, 2015	October 28, 2015
Utilization		> December 2014		> December 2014
Consumable - based on system failure				
EDV + TUBBS (UPA Failed)	August 18, 2014	November 14, 2014	August 18, 2014	November 14, 2014
Water, if no WPA (Ag & Iodinated)	July 28, 2014	September 26, 2014	July 28, 2014	September 26, 2014
O <sub>2</sub> if neither Elektron or OGA	August 19, 2014	November 2, 2014	August 19, 2014	November 2, 2014
LiOH (CDRAs and Vozdukh off)	~0 Days	~13.3 Days	~0 Days	~13.3 Days





# Pertinent ISS Vehicle Issues

- EMU Investigation status to follow in special topics

Issue	Impact to Stage Ops	Rationale
SSU 3A Anomaly	Yes	<p>On 5/8 DCSU 3A RBI-1 experienced a negative trip, indicating current flowing out of RBI 1 towards the SSU.</p> <ul style="list-style-type: none"><li>• Downstream loads have been recovered and channel 3A has been cross-tied to channel 3B.</li><li>• Direction from SSPCB on 6/11 to planned EVA to R&amp;R SSU (8/21)</li><li>• SSU issue not related to MMOD damage to SAW</li></ul>
SSRMS LEE Latching Anomaly	Yes	<p>Degradation has been seen on both LEEs, aborted latching has been seen on LEE A</p> <ul style="list-style-type: none"><li>• Trending shows that LEE lubing and/or replacement will be necessary in the future</li><li>• LEE B used for Orb-2 Capture (LEE A at base on Node 2)</li><li>• LEE maintenance options under discussion (lubing)</li></ul>



# Pertinent ISS Vehicle Issues (cont.)

Issue	Impact to Stage Ops	Rationale
Sequential Shunt Unit (SSU) 3B Power On Resets (PORs)	No	<p>8 recent events, averaging every 4 days</p> <ul style="list-style-type: none"><li>• All occur within first 90 seconds of ISS sunrise, and have typical SSU POR telemetry signatures</li><li>• SSU PORs are seamless from ISS perspective – no impact to loads</li><li>• No indications of degradation or impending failure of SSU</li><li>• Will continue to monitor &amp; trend in attempt to further resolve fault tree to root cause</li></ul>
RPCM LAD62B-A, RPC 12 Trip (Lab CDRA Valves)	No	<p>5 overcurrent trips have occurred while the Lab CDRA is in Standby state.</p> <ul style="list-style-type: none"><li>• First tripped on 4/4 and again 6/25.</li><li>• 2 additional re-closure attempts were made and resulted in trips ~12-13 hours from time of closure</li><li>• Ops Tag-up on 7/8 agreed to perform nominal Lab CDRA activation to satisfy 30 day requirement on 7/9</li><li>• RPC did not trip while in operational for ~24 hrs, but tripped again after being returned to Stby for ~8.5 hrs</li></ul>



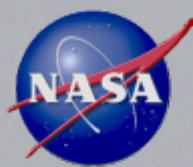


# WHC Status



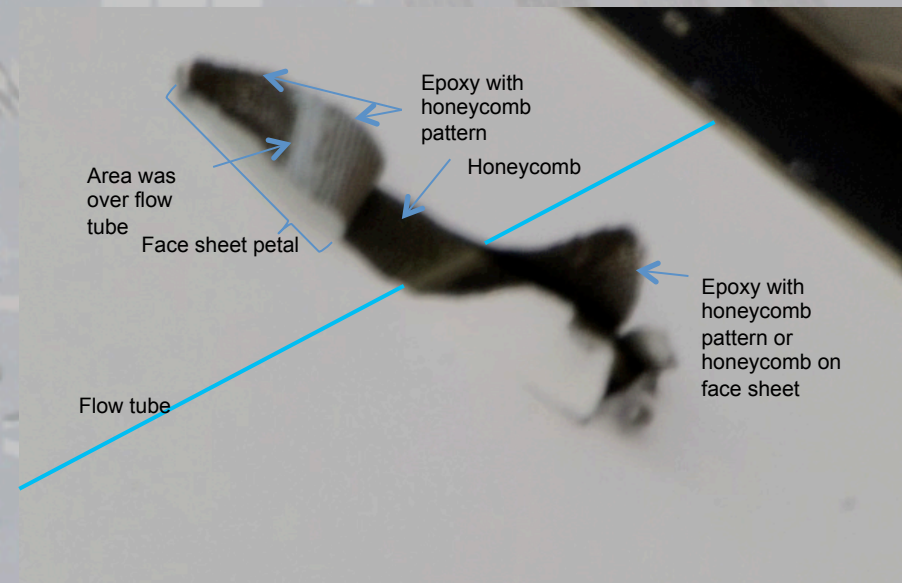
## Resolution of several WHC components

- Pump separator R&R'd on 6/29 due to numerous “check sep” light indications
- Flush tank fill early terminations (34 ml vs 50 ml), effects quality of pre-treat during dosing and downstream UPA operations
  - Water valve block R&R performed July 2nd
- Flush fill tanks nominal
- System returned to nominal operations



# Pertinent ISS Vehicle Issues (cont.)

Issue	Impact to Stage Ops	Rationale
P4 PVR MMOD Strike	No	<p>Imagery review revealed a MMOD impact occurred between 5/12 and 6/20 on panel 3 of the P4 PVR.</p> <ul style="list-style-type: none"> <li>S&amp;M initial assessment shows no apparent structural damage</li> <li>Unclear if damage would impact ability to retract PVR radiator, but currently no plans to do so</li> <li>P4 ammonia mass trending shows no flow tube rupture (Small leaks will need to be trended long term)</li> </ul>







# Pertinent ISS Vehicle Issues (cont.)

Issue	Impact to Stage Ops	Rationale
Water Processing Assembly (WPA) Total Organic Compound (TOC) Breakthrough	Yes	<p>TOCA readings from the WRS indicate that the WPA Multi-filtration beds are seeing TOC breakthrough. MF bed R&amp;Rs are scheduled as TOC approaches 2000 µg/L and are required prior to the 3000 µg/L.</p> <ul style="list-style-type: none"><li>• TOC reading from the WPA was 975 µg/L on 7/9</li><li>• Readings appear to have plateaued over the last few weeks.</li><li>• Likely cause of plateau is due to the N3 CCAA not experiencing a dry cycle since the recent R&amp;R</li><li>• DMSD accumulation happens during dry cycles</li><li>• N3 CCAA went through a dry cycle on 7/9, so it is expected that TOC readings will start increasing.</li><li>• Currently 1 spare on-orbit, 1 manifested on SpX-4, and 2 manifested on Orb-3.</li></ul>



# Increment 39/40 Research Complement Snapshot



## Human Research

Bone & Muscle Physiology Bisphosphonates (Control), Functional Task Test (P), Intervertebral Disc Damage (P), Spinal Ultrasound, Force Shoes, Sprint, <b>Cartilage (P)</b> , Hybrid Training	Cardiovascular & Respiratory Systems Cardio Ox, <b>BP Reg</b> Vision Ocular Health	Human Behavior & Performance Comm Delay Assessment, Journals, Reaction Self Test	Nervous & Vestibular Systems Manual Control (P), Blind & Imagined (↑), <b>Reversible Figures, Space Headaches</b> , V-C Reflex (P)	Integrated Physiology & Nutrition Biochemical Profile, ProK, Repository, <b>ENERGY, Circadian Rhythms</b> , Biological Rhythms 48hrs
Immune System Salivary Markers	Radiation Impacts on Humans <b>ALTEA (↓)</b>	Habitability & Human Factors Body Measures	Crew Healthcare Systems <b>Skin-B</b>	Human Microbiome Microbiome

## Biology and Biotechnology

Microbiology / Cellular <b>Micro-8, NR 16, 18, 20, 21, 22, VIABLE, NR-28, 29, 30, 31, 50, BRIC-18-1, Micro-7, NR Module 9 (EXT)</b> Stem Cells, Cell Mechanosensing-1&2, <b>APEX-02-2, T-Cell Act in Aging, NanoRacks BioRack Exp-1 &amp; -2 Bone Densitometer Validation</b>	Plant Biology <b>BRIC-18-2, BRIC-19, Veg-01, Petri Plants, Biotube MICRO, Seedling Growth 1 (↓), Seedling Growth-2, GRAVI-2</b> Aniso Tubule, Resist Tubule, <b>Plant Gravity Sensing 1, CsPINs</b>
Animal Biology <b>Rodent Research-1, Nanoracks Module 26,</b> Space Pup, Zebrafish Muscle	Macromolecular Crystal Growth <b>CASIS PCG GCF-1 &amp; GCF2 (↓), CASIS-PCG-2 CASIS PCG HDPCG-1&amp;2, CPCG-HM), Merck PCG), NR19, JAXA PCG (#7)</b>
Vaccine Development <b>VA-Clinic, NLP-Vaccine-21</b>	

## Earth & Space Science

Astrophysics/ Heliophysics <b>AMS-02 (E), Solar-SOLACES/SOLSPEC (E), MAXI (E), MCE (E)</b>
Earth Remote Sensing <b>ISS RapidScan (E), HREP-HICO RAIDS(E), IMAX (↑) CEO, ISERV, Windows on Earth, SMILES (E)</b>
Near-Earth Space Environment SEDA-AP (E)
Astrobiology ExHAM (↑), MCE(A-IMAP)

## Educational Activities

Educational Demos EarthKAM, EPO Demos, Story Time from Space-1, <b>EPO Top Experiment, EPO Earth Guardian, EPO Flying Classroom, HAM Video</b>	Commercial Demos JAXA Commercial Education Competitions <b>SPHERES Zero Robotics</b>
Student Experiments <b>NR Module 9 -Terpene (↓), NR Module 9</b>	Other <b>ISS Ham Radio, Cosmo Shoot (↓), JAXA EPO 12 (JAXA Video &amp; JAXA Report)</b>

## Technology Demonstration

Small Satellites & Control Technologies <b>Slosh, VERTIGO, NRCSD (Dove(Planet Labs), TechEdSat-4, GEARRS, Micro-MAS, LamdaSat)</b>	Characterizing Experiment Hardware <b>SpinSat, Cyclops NanoRacks Module-27, METERON OpsCom-2, LIRIS, MVIS Controller-1</b>	Communications & Navigation <b>DTN, OPALS (E), SCAN Testbed (E), Rings, Vessel ID</b>
Spacecraft & Orbital Environment <b>STP-H4 (E), MISSE8 (E)</b>	Radiation Measurements & Shielding <b>Radiation Environment Monitoring (REM), HiMassSEE, DOSIS-3D, Area PADLES 12, Radi-N2</b>	Imaging Technology <b>3DA1 Camcorder, HDEV (E), ESA NightPod,</b>
Food & Clothing Systems <b>IVA Clothing Study, SPACETEX(↑)</b>	Robotics <b>HET-Smartphone, Robonaut, RRM-Phase 2 (E), Smartphone MM, Haptics-1 (↑)</b>	Life Support Systems & Habitation <b>AMO TOCA, AMO EXPRESS, UBNT</b>
	Avionics & Software <b>SNFM</b>	Repair & Fabrication Technologies <b>3D Printing in Zero G (↑)</b>
		Air, Water, Surface Monitoring <b>Multi-Gas Monitor, WISENET (↑)</b>

## Physical Sciences

Combustion Science <b>FCF/FLEX-2, BASS-2, Atomization</b>	Material Science <b>NR-24, DECLIC DSI-R, EML, MAGVECTOR, MSL SQF, MICAST-2/CETSOL-2, Soret Facet, Alloy Semiconductor, Ice Crystal 2, Hicari</b>
Complex Fluids <b>ACE-M2, ACE-M3, BCAT-4 (↓), BCAT-KP, BCAT-C1</b>	Fluid Physics <b>CFE-2, CCF, DECLIC HTI-R* Dynamic Surf 1, 2, 3, Marangoni UVP2R, FASTER, FASES</b>

**Key:** ■ NASA ■ CSA ■ ESA  JAXA  NASA – Commercially Funded

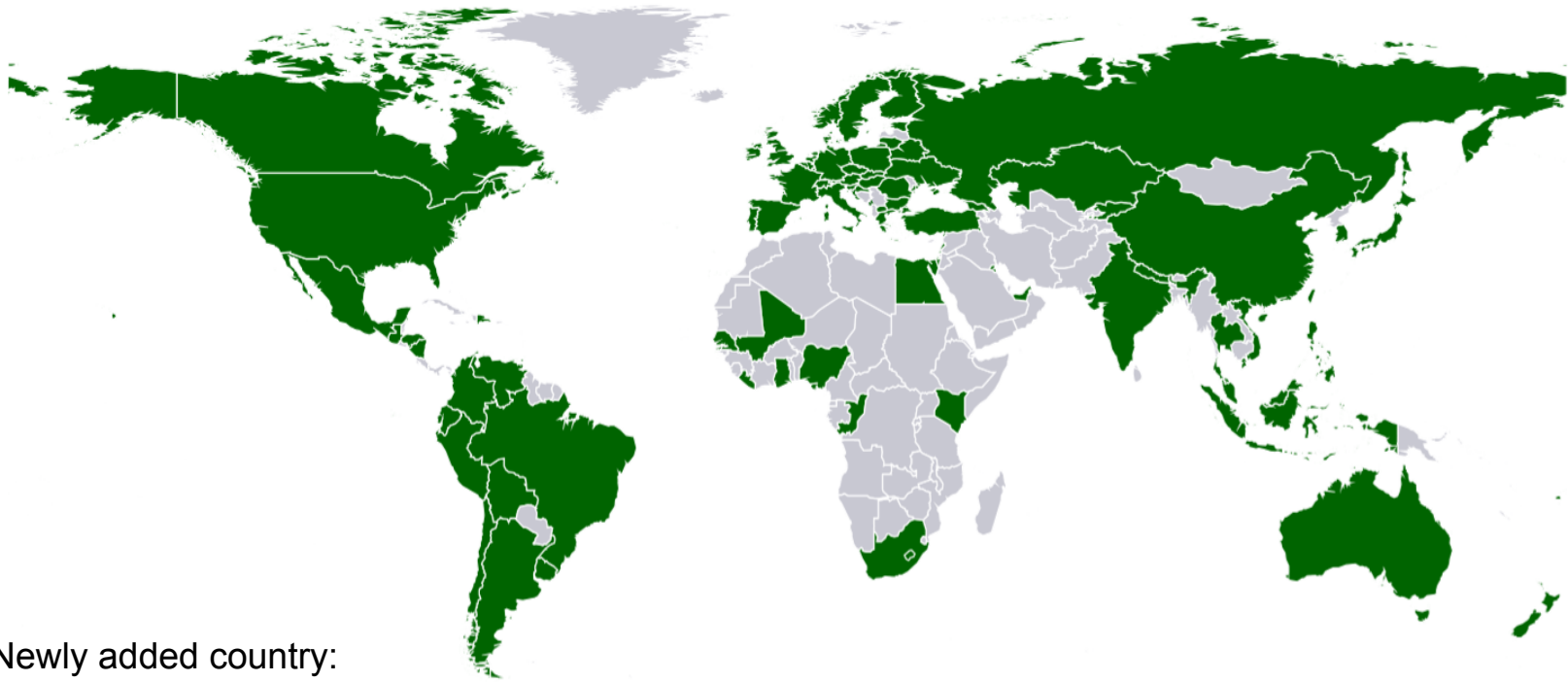
(P) Pre/Post BDC only, no In-flight ops  
(↑ ↓) Launch or Return only

(E) External Payload  
\* CEF approval pending

Last Update: 7/11/14



# ISS Research Participation



Newly added country:

- Lithuania (NanoRacks)

83 countries and areas



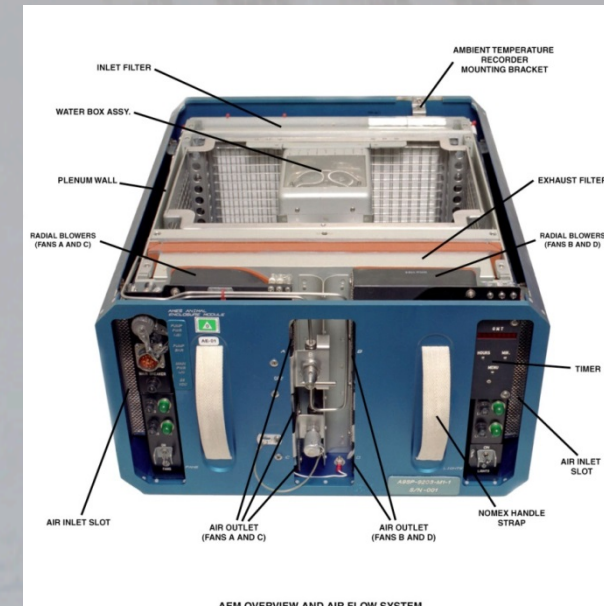
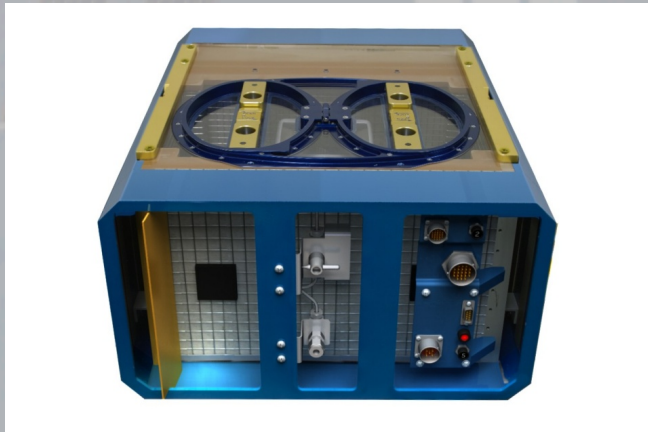
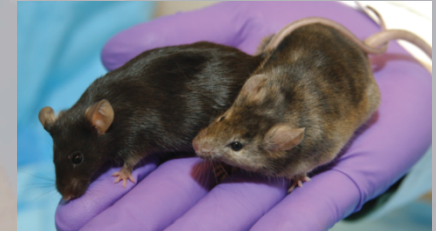


# Increment 40 New Research Investigations



**Rodent Research-1:** “The lack of an animal facility for rodents on the ISS suitable for long-duration studies on adult animals is a major research impediment that will hamper the ability to obtain information important for maintaining astronaut health and fitness for duty.” -*NRC Decadal Survey, 2011.*

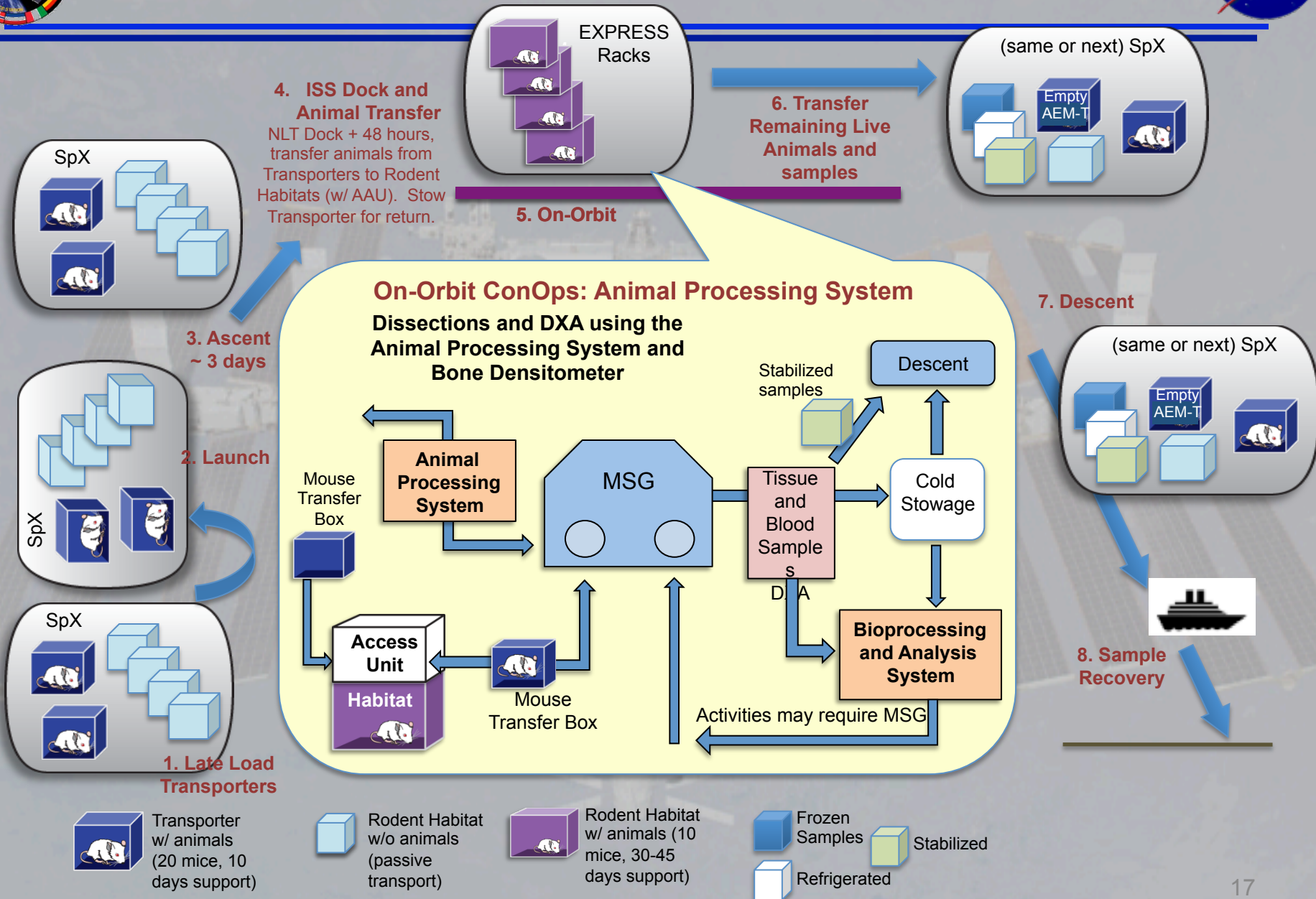
- 10 NASA mice: Evaluation of hardware and on-orbit operations
- 10 CASIS mice: Pharmaceutical company evaluating muscle atrophy
- Based on existing AEM design
  - Flown 27 times on Shuttle
  - Modified to meet ISS needs (reduced acoustics, added cameras, improved airflow)
- Single MLE unit houses 10 mice or 3 – 6 rats (20 mice on SpaceX-4)
- Temperature and RH monitoring, no active thermal control
- Transfer animals to a clean Rodent Habitat with a full complement of food and water after 20 - 30 days to achieve longer duration missions
- Improved science and animal husbandry through video monitoring and in-flight access
- Animals housed in two groups of five on either side of the Habitat
- Animals loaded in the Transporter at L-25 hrs
  - Support up to 2 launch attempts before change out with a new Transporter



AEM OVERVIEW AND AIR FLOW SYSTEM



# Generic RR Concept of Operations





# ISS Top Program Risk Matrix

## Post April 16, 2014 PRAB



### Corrective/Preventative Actions

None

### Watch Items

No Watch Items Elevated

### Continual Improvement

None

L  
I  
K  
E  
L  
I  
H  
O  
O  
D

5				2	1
4			3	2	
3		1	3		4
2		1			
1					
	1	2	3	4	5

CONSEQUENCE

Low		Medium		High	
C – Cost	S – Schedule	T – Technical		Sa – Safety	
▲ – Top Program Risk (TPR)					
Added: 6484					
Removed: 2810 - RS MM/OD Shielding and 5688 - ISS Solar Array MGNT					
Rescored: 6169					

### Risks (L x C)

Score: 5 x 5

▲ 6352 - Lack of Assured Access to ISS - (OH) - (C,S,T,Sa)

Score: 5 x 4

▲ 6370 - ISS Pension Harmonization - (OH) - (C)

▲ 6344 - ISS Operations Budget Reduction - (OH) - (C)

Score: 4 x 4

▲ 6372 - Full ISS Utilization at 3 Crew - Level 1 - (OZ) - (C,S)

▲ 6439 - EPROM Memory Leakage - (OD) - (C,S,T,Sa)

Score: 3 x 5

▲ 6484 - ORDEM 3.0 Orbital Debris Model- CA, OB, OC, OD, OE, OK, OM, ON, OX - (S,T,Sa)

▲ 6444 - ISS Cascading Power Failure - (OM) - (C,S,T,Sa)

▲ 6450 - Potential Inability to Support ISS Critical Contingency (& other) EVA Tasks - (XA) - (C,S,T,Sa)

▲ 6382 - Structural Integrity of Solar Array Wing (SAW) Masts due to MMOD Strikes - (OB) - (S,T,Sa)

Score: 4 x 3

▲ 5269 - The Big 13 Contingency EVA's - (OB) - (S,T,Sa)

▲ 6169 - Visual Impairment / Intracranial Pressure - (SA) - (C,S,T,Sa)

▲ 6438 - C2V2 Comm Unit Vendor Misinterpreting ISS Requirements - (OG) - (C,S,T)

Score: 3 x 3

▲ 6452 - Lack of Sufficient Sparing for the Ku-Band Space to Ground Transmitter Receiver Controller (SGTRC) to reach 2020 - (OD) - (C,S,T)

▲ 6420 - NDS Qualification Schedule - (OG) - (C,S,T)

▲ 6408 - FGB Sustaining Contract and FGB spares plan post 2016 undefined - (OB) - (C,S,T,Sa)

Score: 3 x 2

▲ 6039 - Carbon Dioxide Removal Assembly (CDRA) Function - (OB) - (C,T,Sa)

Score: 2 x 2

▲ 5184 - USOS Cargo Resupply Services (CRS) Upmass Shortfall - 2010 through 2016 - (ON) - (S,T)



# Visiting Vehicles Status







# Orb-2 Mission Success!



Orbital successfully launched to ISS on 7/13/14

Photo Credit: Orbital



# Orbital-2 Mission Status



- Mission Planning
  - Manifest assessment 1660 kg upmass; 1346 kg disposal
  - Results and findings of AJ26 test anomaly reviewed for impacts to Orb-2 (engines passed 3 ATP tests)
  - Successful Launch occurred on 7/13/14
  - Berthed to the ISS on 7/16/14
- Pressurized Cargo complement
  - Four passive lockers (including two double cold bags)
  - Research hardware includes:
    - Nanosatellites designed to take images of Earth
    - Smart Synchronized Position Hold, Engage, Reorient Experimental Satellites (SPHERES) features a sensor and multiple cameras to enable 3-D mapping and robotic navigation
    - Student experiments are on board as part of the Student Spaceflight Experiment Program
- Cygnus Status
  - Initial cargo loading was completed on 3/31/14
  - Service Module (SM) mated to PCM on 4/4/14
  - Mate with Antares was completed on 7/3/14
  - Late and final cargo loads were completed on 7/6/14 and 7/8/14
- Antares Status
  - Rollout to pad was completed on 7/10/14 (weather delays, Antares issue resolution)

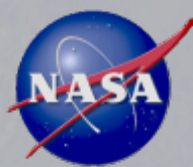


Photo Credit: Orbital





# ATV5 Mission Status



## ➤ **ATV5: Georges Lemaître**

### ➤ **Mission Planning**

- Manifest assessment > 6000 kg upmass/disposal
- Delta Phase III SRP was held in early Mar. A new Hazard Report on the rendezvous experiment hardware (LIRIS) mounted on ATV5 front cone was also reviewed with no issues
- Stage Operations Readiness Review (SORR) was held on 7/16/14
- Post SORR, issue with Ariane's 3<sup>rd</sup> stage ACS prop fill (in work), Launch NET 7/29, maintains docking on 8/12

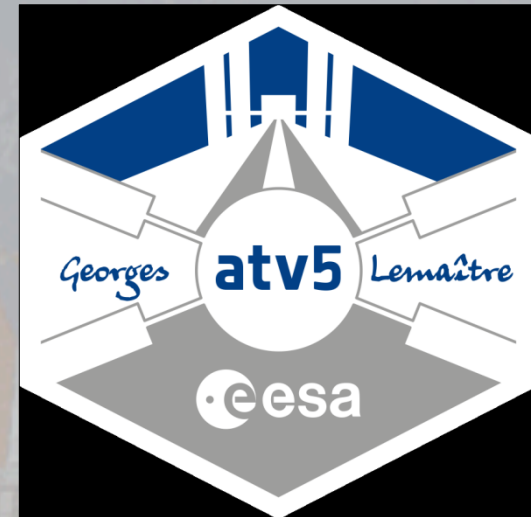
### ➤ **Cargo**

- Nominal cargo load complete
- Late load cargo at launch site complete



### ➤ **On-orbit Status**

- Performing an ISS fly-by a few days before docking to allow experimental rendezvous sensors to collect data
- On-orbit duration for ATV5 is currently scheduled through late Jan 2015; extension into February is under discussion in order to monitor re-entry in optimal conditions



**Georges Lemaître (ATV5)**



**ATV5 processing in Kourou**



**ATV5 cargo rack loaded**



# SpaceX-4 Mission Status



## ➤ Mission Planning

- Manifest assessment 2272 kg upmass; 1734 kg return cargo

## ➤ Pressurized cargo

- GLACIER, Commercial Generic Bioprocessing Apparatus(CGBA), Rodent Transporter and Habitat, SpinSat, Cyclops, Bone Densitometer, Microgravity Science Lab (MSL), and 6 Cold Bags

## ➤ External Cargo

- ISS RapidScat (RapidScat Nadir Adapter and RapidScat Instrument) for installation on Columbus Starboard Deck-X (SDX)

## ➤ Dragon Status

- Cargo Integration Review (CIR) was completed on 5/21/14
- RapidScat trunk installation was completed on 6/26/14
- Dragon trunk arrived at the Cape on 6/25/14. Capsule arrived on 7/9/14
- Software end-to-end test is planned for late Jul/early Aug

## ➤ F9v1.1 Status

- First and Second Stage shipping to the Cape is scheduled for mid-Aug
- Interstage receipt at the Cape is scheduled for mid to late Aug



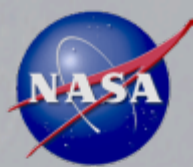
Dragon production at Hawthorne, CA

Photo Credits: SpX





# Orbital-3 Mission Status



## ➤ Mission Planning

- Manifest assessment 2290 kg upmass; 1714 kg disposal
- Safety Review Panel (SRP) Phase 3 Part 1 review was conducted on 6/25/14 with Part 2 scheduled for 7/24/14
- Post Qualification Review (PQR) is scheduled for 8/12/14 (TBC)
- Mission Readiness Review (MRR) is scheduled for 8/27/14
- Launch being assessed for 10/1

## ➤ Pressurized Cargo complement

- ISS cargo manifest was delivered to Orbital in May

## ➤ Cygnus Status

- Cargo Integration Review (CIR) was completed on 6/4/14
- Pressurized Cargo Module was delivered to WFF on 6/11/14
- Passive Common Berthing Mechanism (PCBM) 1410 testing was completed on 6/27/14
- Final Integrated Systems Test (FIST) was completed on 7/2/14

## ➤ Antares Status

- Stage 1 Core was delivered to WFF on 2/2/14 and is in the HIF
- Engines E15 and E16 were delivered to WFF on 3/21/14 and 7/7/14
- Castor 30 XL was delivered to WFF on 5/16/14
- 270 degree fairing half was delivered on 7/1/14; 90 degree half is expected in Aug
- First flight of Castor 30XL and longer upper stack and the first enhanced Antares launch vehicle



**Orb-3 Pressurized Cargo Module (PCM)**





# SpaceX-5 Mission Status



## ➤ **Mission Planning**

- Manifest assessment 2073 kg upmass; 1580 kg return cargo
- Launch planned for December 2014

## ➤ **Pressurized Cargo**

- NASA delivered L-5 month manifest update on 5/12/14
- GLACIER, Commercial Generic Bioprocessing Apparatus (CGBA), Polar (GLACIER successor), Bioculture System, and 5 Cold Bags

## ➤ **External Cargo**

- Cloud Aerosol Transport System (CATS) Interface Control Document (ICD) baseline for external payload is planned to be completed by Cargo Integration Review (CIR) in Aug

## ➤ **Dragon Status**

- Trunk avionics checkouts are scheduled to run through mid Jun
- Electromagnetic Interference/Compatibility (EMI/EMC) testing is scheduled for late Jul
- Trunk and capsule are scheduled for shipment in mid Aug

## ➤ **F9v1.1 Status**

- First Stage tank/octaweb integration is planned to begin in early Aug
- Second Stage integration ongoing with plan to ship to TX in late Aug
- Interstage proof test is expected in late Aug
- Delivery of hardware to the Cape is planned for late Sep

# *EMU Suit Investigation Status*







# EMU Suit Investigation Status

- Fan pump separator returned from 3011 in December 2013, clogged drums holes, cause of water in the suit issue (silica agglomeration)
- 3 of 10 Ion exchange beds returned, completely saturated and releasing
  - All suits exposed via numerous ALCLR runs
  - JSC Bldg 7 water quality of Ion bed processing not up to DI quality water standards, source of contamination
- New processes put in place to produce clean Ion exchange beds (charcoal cleansing/rinse, water quality monitored continuously)
  - 2 new beds flown on 38S (late March), 2 more on SpaceX-3, 4 on Orb-2
- Based on water samples and Ion Exchange Beds returned on 36S, water system was flushed 3 times (EMU suits and the airlock water loop) and refilled with WPA water
  - Post flush water samples returned on SpaceX-3, reflecting compliant water quality (new specification)
  - Monitoring system water quality for silica leach back
- New fan pump separators installed into suits 3010 and 3005 post water flush
  - 3011 FPS R&R'd in December – additional R&R of 3011 FPS scheduled
  - Returned FPS from 3010, 3005, and 3015 relatively clean (minor particle in 1 of 8 drum holes on 2 FPS)
- New 3003 suit flown on SpaceX-3 and successfully checked out
  - Suit 3015 returned on SpaceX-3 (sublimator issue)
- All indications of major contamination pointing toward Ion Bed Processing (over the years)
  - Additional escapes in properly controlling water quality “touching” the suit corrected. Previous over application of Braycote on 3011 seals may have aided in silica agglomeration
  - Water audits conducted at all sites/sources, mitigation plans implemented, grease now applied with wipes
- In the midst of the investigation and corrective actions, 3 contingency EVAs were conducted with nominal suit performance (HAP incorporated)
- Summary of Status :
  - Water loop returned to nominal conditions post flush, follow on sample plan in place (leach back monitoring)
  - Suits 3005, and 3010 have new FPS installed post water cleanup (flush and new Ion Exchange beds)
  - Suit 3003 completed successful checkout on orbit post water cleanup
  - Suit 3011 to have its December exposed FPS R&R'd land “old” unit will return on 38S (crew time permitting)
  - Suit 3015 sublimator presently undergoing TT&E, anomaly still under investigation





# EVA Suit Investigation Status

- 49 EMU Mishap Investigation Board Recommendations aggressively worked
  - MIB identified priority recommendations for return to nominal EVA
- To address numerous MIB findings, the EMU was evaluated against ISS design and safety standards to identify areas of higher risk that may have been previously accepted or missed
  - Fundamental Approach on EMU fault tolerance (zero fault tolerant plus ability to safely terminate EVA = 1 FT)
  - Seven hazard reports related to the water in helmet hazard have been updated for planned EVA
    - Loss of Visibility, Loss of EMU Cooling, Excessive CO<sub>2</sub> in the Ventilation Loop, Excessive Liquid in the EMU Helmet, Water Contamination of EMU Systems, Inability to Ingress, and Water Processor Assembly
    - Seven NCRs generated against these 7 Hazard Reports
      - ✓ Maximum Design Pressure is single fault tolerant
      - ✓ Water System Seals utilizing single seals
      - ✓ Inability to ingress
      - ✓ Inadequate Water Quality – residual risk with quality control
      - ✓ Electrical Systems – single string, fail safe approach with terminate
      - ✓ CO<sub>2</sub> removal – single CO<sub>2</sub> removal system, margin maintained for safe terminate
      - ✓ Fracture Control – assessment in work
  - All EMU hazard reports will be revised (completed April 2015)
- Flight rules and procedures updated, real time and backroom support teams integration/coordination greatly enhanced
- Water sample plan put in place (onboard and return) and increased emphasis on forensic review of returned hardware items (beds, filters, EVA ORU components, etc)
- ISS Program now managing EVA Management Office similar to other CAMs (roles and responsibilities clearly defined)
- Special EVA Operations Readiness Review planned for August 11<sup>th</sup> with an EVA Flight Readiness Review (FRR) to follow
  - Complete review of findings, root cause determination status, safety hazard analyses, updates to procedures and operations products, and formal MIB closures to be addressed with the goal of determining readiness for restoring nominal ISS EVA capability
  - Review is a formal gate to support planned EVAs on August 21<sup>st</sup> and 29<sup>th</sup>